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F-284

FAIRCHILD-POLAROID

OSCILLOSCOPE CAMERA

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AN ADDRESS BY
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FAIRCHILD
CAMERA AND INSTRUMENT
CORPORATION

The Model F-284

FAIRCHILD-POLAROID OSCILLOSCOPE CAMERA

Transcript of an Address Delivered by Mr. Wenzel J. Schubert, Sales Engineer of the Fairchild Camera & Instrument Corp., before a Group of Electrical Engineers and Photographers, at the Naval Research Laboratory, Washington, D. C., June 6th, 1950.

FAIRCHILD CAMERA and INSTRUMENT CORPORATION
Jamaica 1, N. Y.

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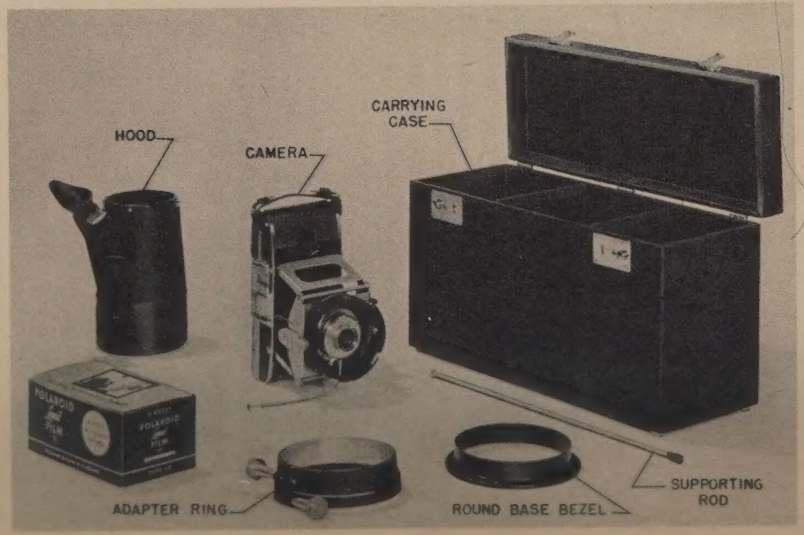
FAIRCHILD-POLAROID
OSCILLOSCOPE
CAMERA KIT



Introduction

Thank you, Commander, and good morning gentlemen. Photography has long been both a hobby and a business with me. I enjoy it thoroughly, and I am especially happy to appear before you this morning because I believe we have a new camera to present that is a real addition to electronic laboratory instrumentation.

Reason for Being

Every laboratory instrument must have a reason for being—it has to fill some definite need or purpose. This new Fairchild camera is no exception. Its specific purpose is to deliver a photographically accurate record of the oscilloscope's trace within seconds after the trace has occurred. This immediately-available record makes it possible for laboratory work to proceed continuously, instead of intermittently, in those cases where several traces must be recorded to complete a project—it eliminates those waiting periods that are now necessary while conventional film is being processed.

Perhaps I can best illustrate this point by relating an incident that occurred last week in one of the large airplane plants on Long Island:

An engineer had been assigned to carry through a series of impact tests on a certain instrument. This was done by dropping a weight from varying heights upon a hydraulic table. The resulting data appeared as a transient that crossed the face of the oscilloscope tube just once.

So, on this particular morning, he organized his set-up and made his first drop. He photographed the trace with a conventional press camera, and then he sent the sheet film holder to the darkroom for processing. He and his assistant and a mechanic then waited. Twenty minutes later the darkroom phoned that the film could be examined. He went down, examined the wet film in the darkroom, and made his notes. He returned to his set-up, made the necessary adjustments to his apparatus, made his second drop, sent the second sheet film holder to the darkroom, and again they waited. Twenty minutes slipped by; twenty-five; and finally the engineer phoned the darkroom. He learned that both photographers had been called away on an emergency job and that it would be two hours before he could see the negative. He dismissed his helpers, and turned to other work. It was shortly after lunch before he saw the wet film. He made his notes, but it was three o'clock before he could get his

assistant and mechanic back on the job. When they reached the set-up, they found that another group had "borrowed" the oscilloscope, which was now tied up for the rest of the afternoon.

He didn't get re-organized until the following morning, at which time I had an appointment to demonstrate the Fairchild-Polaroid Oscilloscope Camera to him. When I arrived, he immediately asked whether I could record his trace. It took but two minutes to set up the camera, he made his third drop, and I had a photographic print ready before he was ready to examine it. He pronounced the print satisfactory, made the indicated adjustments to his apparatus, and made his fourth drop. Again the print was ready before he was, and in the course of the next 40 minutes he made nine drops and completed his project.

This engineer estimated that it would have taken a minimum of two to three days to complete this particular assignment, using the conventional photographic methods at his command, whereas with this Fairchild-Polaroid Oscilloscope Camera available, he could have completed the entire job within an hour.

But that isn't all; this camera is equally useful for much routine electronic laboratory work that is now sketched, or carried only in the engineer's memory. As a matter of fact, it is so convenient, and results are so promptly produced, that where this camera is available, many traces will be photographed that previously weren't recorded at all because their importance didn't justify the time and bother that conventional photography involved.

How Accomplished

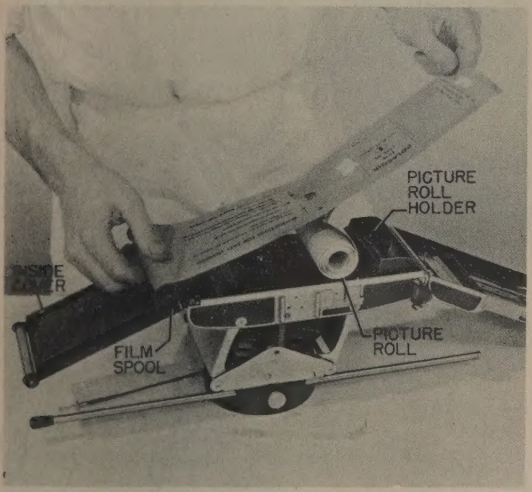
This immediately available and photographically accurate record of the oscilloscope's trace is made possible by utilizing the new Polaroid-Land one-step system of photography.

This Polaroid-Land process is a new invention, worked out by Dr. Edwin H. Land, President of the Polaroid Corporation, Cambridge, Mass. To my thinking, it is such a real achievement in chemical engineering that it deserves a description. Parenthetically, perhaps, I should add that there is no connection between Fairchild and Polaroid.

The Polaroid-Land process delivers a positive paper print within a matter of seconds after the exposure. In addition, its apparatus is so compact that it can be included in a portable camera. Also the whole process is so simple that a person entirely unacquainted with

and uninterested in photography can make excellent prints.

See, here is the film and the paper roll. (Exhibiting) This smaller roll contains the film, which is quite conventional, excepting that the emulsion is on paper. This larger roll contains both the paper for the prints and the processing jelly. The print will be made on these neatly masked off rectangles. These pods that run crosswise the paper contain a measured amount of the processing jelly. You will notice that both film and paper are attached to a common leader.



FILM IS EASILY INSERTED IN CAMERA

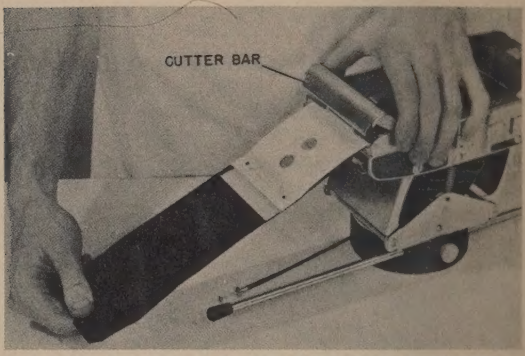
Loading the Camera

Now let us load the camera. The film fits into these brackets, and the paper drops into this compartment. We now close the inner back. The leader is brought down and the outer back is locked. We now draw out the leader until it stops, thus positioning the first film. And now we are ready. As you have noted, this loading took less than a minute.

The Camera

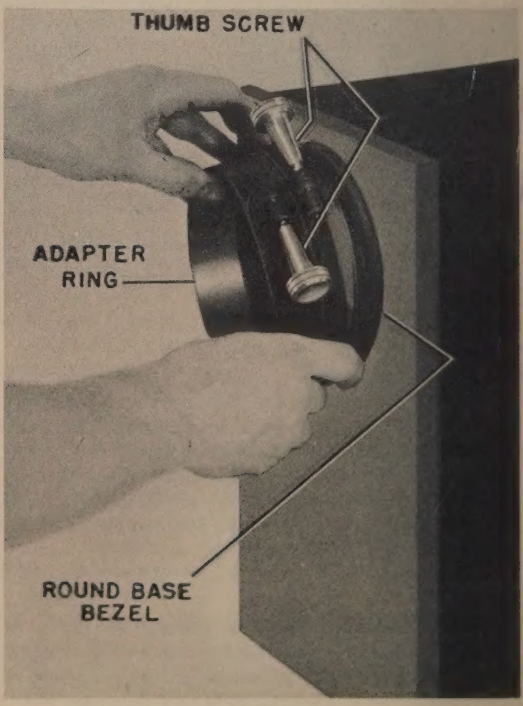
Before actually taking a picture we must, of course, set up the camera. It consists of but three units, and it can be set up or detached in two minutes. To illustrate this point will somebody now time me?

Of course, we will need some means for attaching

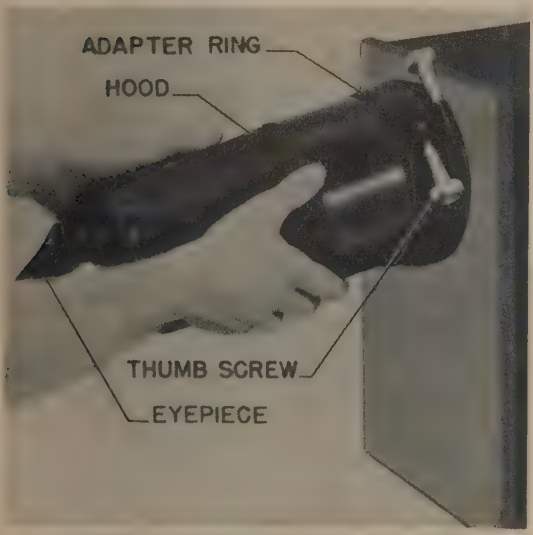


CAMERA LOADED - PAPER WRAPPER REMOVED

our camera to the oscilloscope, and so our first unit is the adapter ring. As you can see, this is a simple casting, machined on one end, split, and provided with a couple



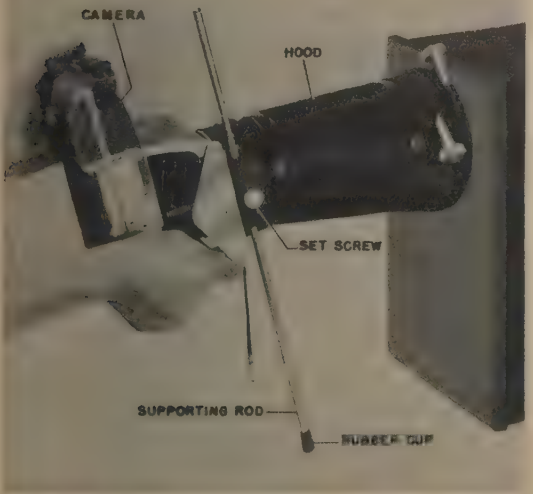
ATTACHING BEZEL AND ADAPTER RING TO SCOPE



CAMERA HOOD IS QUICKLY ATTACHED

of thumb screws, thus making a pair of constricting rings. The larger ring fits over the oscilloscope's bezel.

Our second unit is the hood, which serves a triple



CAMERA IS HELD IN POSITION BY BAYONET LOCKS

purpose. It bars extraneous light, it establishes focus accurately (an important point when we are working with large lens apertures at close distances) and it provides a simple bayonet lock upon which to attach the camera. We now slip this hood inside the adapter ring, and when its rubber lip is against the face of the tube, we know that the camera is sharply focussed.

We now come to the camera unit itself, which we quickly snap into position. However, the face of the oscilloscope wasn't designed to carry a load, and while the camera is light (this whole assembly weighs less than eight pounds) we thought it best to provide additional support. For that reason, we will snap the camera off and put this rod through the bayonet locking device. I now return the camera to the hood, and we are ready for work. How long has it taken?

(A member of the audience reported the elapsed time as two minutes and ten seconds.)

Well, I was a bit slow; I didn't come within my two minutes.

The Exposure

The proof of this camera is in its print, so let us now make one. This particular oscilloscope has a flat faced, green tube, over which is placed a grid illuminated with red light.

Somewhat to my surprise, I have found considerable diversity of opinion among engineers as to what constitutes the most satisfactory record. One man likes his prints quite delicate, believing that he can measure them more accurately. Another prefers his prints strong and contrasty. Fortunately, in the case of slow single transients and stationary patterns, we can produce either extreme, or any degree between.

So I will now make two exposures, one to produce a delicate image; the other to produce a strong and contrasty one. The first will be a bulb exposure, made as fast as I can operate the release, which will give an exposure of about 1/10th second. The lens aperture is set at f/5.6. This will produce a delicate trace upon the print, and I will now superimpose upon it a record of the grid. The grid has been turned on while I recorded the trace, but since it is illuminated by red light, to which the film is relatively insensitive, it didn't record sufficiently to be visible. I will now turn down the intensity of the 'scope until the trace has disappeared, and I will next make a second exposure to record the grid. Since I already have a delicately recorded trace, I will make an equally delicate record of the grid, too,

so as not to overshadow the trace. Three seconds should do the trick.

Now, by a slight push, I snap the camera into position for a second exposure upon the same print.

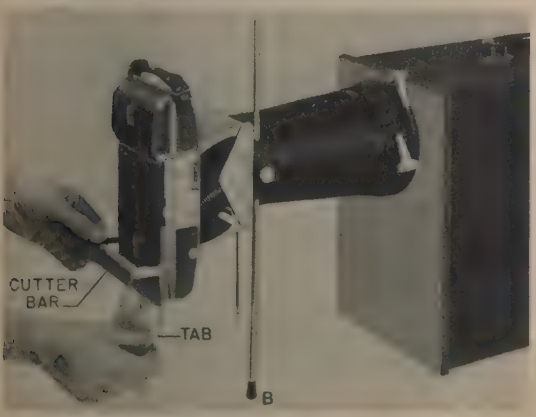
This time I will give the trace a full second's exposure so as to make a strong record, and I will follow that with an exposure of about ten seconds to record the grid.

The Processing

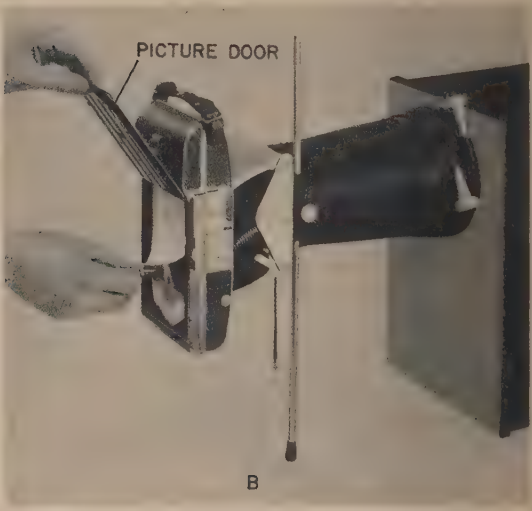
Now we are ready to process our print. If you remember, we placed the film in the lower compartment of the camera, about here. The paper is in the upper compartment, about here. At about this point (indicating) there is an apparatus which approximates a wringer. As I draw this tab from the bottom of the camera, I also draw the film up from behind the lens. It is joined by the paper at this point (indicating) and both pass through the wringer together, thus breaking that pod of processing jelly you saw, and rolling the jelly smoothly between film and paper; at the same time pressing them into intimate contact. Both are now in our finishing department in the back of the camera, and in about 60 seconds the print will be ready. Will someone time 60 seconds, please?

While our print is processing, let me say that it will come out only slightly damp, and it will be dry within about three or four minutes. During the first few seconds after it is lifted out, the emulsion is soft enough to be marred by rough handling, but it quickly hardens.

Our 60 seconds is up now—this processing time



PICTURE EXPOSED - PULL TAB TO PROCESS



PROCESSING COMPLETE - REMOVE PICTURE

FINISHED PRINT SHOWING TRACE WITH IMAGE OF GRID FOR EASY EVALUATION

isn't too critical; anything between about 50 and 80 or 90 seconds will produce a good print at normal temperatures. We now open the back of the camera and lift out our print. Here it is, a good, clear record, with the grid superimposed for easy evaluation. Isn't that nice? This print is ready for immediate evaluation, and it will be dry in a matter of minutes. Of course data can be put upon the back of this print, or it can be entered in your notebook and the print mounted beside it.

Print Evaluation

When the grid is recorded directly upon the print, as has been done here, measurement is simple. If no grid has been recorded, then a grid, such as those commonly used on the 'scope, may be laid over the print, and—always remembering that the print is one-half life size—it can be measured. Or, of course, the image can be measured by conventional methods.

It is entirely possible, also, to expose two nearly identical traces on top of each other. Any differences will then show up immediately. This plan may save much time in evaluation.

Camera Construction

When the Polaroid-Land camera was first announced a couple of years ago, it immediately occurred to us that this would be an excellent means for recording the oscilloscope's trace. Naturally our first thought was to record the image in full life size. We found the standard lens (although doubtless well suited for amateur use for which the Polaroid-Land camera is designed) rather slow for oscillography. Other difficulties arose, such as the cost and bulk and weight of the high speed lens that would be needed; its narrow depth of field and depth of focus; the fact that the actual picture size is slightly less than four inches and thus it won't quite accommodate the whole of the tube's image, etc.

So we turned to a half life-size image instead, and decided to put two exposures upon each print. This reduced the size, the cost and the weight of the lens, it cut running expenses, and made the whole outfit more compact, more convenient and more practical. It also made it necessary to develop the special, spring-actuated, two-position device which you noticed when we operated the camera a few minutes ago. In the upper position, the lens is centered in front of the lower half of the film; in the lower position the lens is centered in front of the upper half of the film.

Since we had to have a new and faster lens, we enlisted the cooperation of the Wollensak Optical Company, of Rochester, N. Y., and they designed a new lens specifically for this work and for this camera. It has been named the Wollensak Oscillo-Anastigmat, and it gives top performance at this extreme close-up, where most general purpose anastigmats perform but poorly. This lens is of 3 inches focal length, and its full aperture is f/2.8. Its depth of field, figured at full aperture and using a 1/200-inch circle of confusion, is plus or minus 3/32-inch. It can be stopped down to f/22. It has a hard anti-reflection coating. This lens is sixteen times faster than the lens on the standard Polaroid-Land camera. This is, of course, no reflection upon the Polaroid-Land camera's lens—we simply had to have a much faster lens of a different type for this work. Our lens is mounted in a conventional Wollensak Alphax between-lens shutter, having speeds of 1/25th, 1/50th and 1/100th seconds; also time and bulb.

QUESTIONS

Now perhaps I can best continue this subject by anticipating some of the questions I know are in your minds. If there is a photographer in this audience, I well know what he is thinking:

"*How permanent are the prints?*" My own personal experience goes back one and one-half years, and I cannot detect any difference between the first prints I made and those that come from the camera today. Here, however, is the official statement from the Polaroid Corporation, Cambridge, Mass., over the signature of Mr. William J. McCune:

"We believe that these photographs are at least as stable as prints made by the average photo-finisher, using the standard photographic process. We have hundreds of prints which have been in our possession for a number of years with no noticeable change in stability."

"*How fast a trace can be recorded?*" Work is still going forward upon this point, and I can give only an interim statement. Also any answer to that question must be necessarily qualified.

The fastest trace that we have recorded thus far was at the rate of 1-inch/micro-second. But that statement, standing alone, means little. For example, blue tubes record much faster than green tubes. Photographically speaking, individual tubes and individual oscilloscopes vary considerably, even among 'scopes and tubes

from the same manufacturer and of the same model. The intensity setting, the accelerating potential, and accuracy with which the dot has been focussed in the tube, and the presence or absence of a grid or filter, all count importantly.

The shape of the trace, and the particular part of the trace that imparts the desired data also make considerable difference in writing speeds, for, in most cases, the speed of the dot is far from constant. In a simple sine wave, for example, the dot's speed during the rise time may be fifty times faster than its speed as it rounds the crest of the curve. Therefore, with an extremely high speed single transient showing this sine wave, we might well get an excellent record of the crests whereas the rise time would not be recorded to any measurable extent. This principle, of course, holds true in the case of many trace forms.

Perhaps I should emphasize the importance of the accelerating potential. The curve showing writing speeds ascends rapidly especially in the lower voltages. For example, doubling the accelerating voltage from 1.5 KV to 3 KV increases writing speeds approximately ten times.

Bearing these factors in mind, the speed of 1-inch/micro-second which I mentioned, was recorded from a P-11 (blue) tube, with an accelerating potential of 3KV, the dot was sharply focussed in the tube, and the intensity setting was at the maximum for greatest intensity. No grid or filter was present. The camera's lens was set at full aperture of f/2.8, and the dot was travelling in a straight line across the tube. This speed was recorded on a single 'scope and tube; another might have been faster or slower by a factor of twice or one-half.

If the tube had been green, we would expect the speed to be reduced to about 20%, for, like all other films, the Polaroid-Land film is most sensitive to blue and to the ultra-violet light that lies just beyond the range of human vision.

Top writing speeds, therefore, depend upon many factors.

Perhaps I should mention here that when extreme speeds must be recorded, we may resort to a simple method of pre-solarization that will double, or, possibly, triple the speed of the film—for pre-solarization is at its best in oscillography.

But, all in all, the electronics man at present has an edge on the photo-chemical engineer—he can build 'scopes whose top trace speeds are beyond the capacity of any present-day cameras. Also this camera of ours

isn't that will-o'the-wisp of a truly universal model that all camera builders are constantly seeking. Nor is it for those few laboratories where single transients of extreme speeds are the rule.

But this new camera does open new fields, it does have wide usefulness, and in the great majority of laboratories and shops it will be a boon that will save its cost many, many times over each year.

"*Can you record all kinds of traces?*" We can record most, but not all. Photographically speaking, there are three types of traces: 1) the exactly repetitive, or stationary pattern, 2) the single transient, that is, the trace that crosses the tube's face just once, and 3) the continuously varying transients. These latter are repetitive, but each trace differs from its predecessor.

The stationary patterns are easy. It makes no difference how fast the dot that makes them is travelling, for so long as it exactly repeats itself, at least for a brief period, we can hold the camera's shutter open until its cumulative effect has produced a measurable record.

The single transients we discussed just a moment ago. We can record most of the single transients generally encountered, but there are some that are simply beyond the capacity of this camera.

The continuously varying transients cannot be recorded by any still camera, unless the variation is so slow that we can stop the pattern we desire with a short shutter exposure, of, say, 1/50th second. This presupposes conditions that make such a short exposure possible. I lately ran across one instance in which an engineer asked me to photograph several varying single transients on top of each other. He then traced a pencil line down the center of the group and thus established an average, the average being the data he sought.

The answer to this question is, then, that we can record most, but not all, the traces usually encountered.

"*How nearly is the 2:1 ratio maintained in your prints?*" Within 3.4%, plus or minus. In arriving at this figure, our engineers took into consideration the fact that the hood might be pushed tightly or loosely against the tube's face; the variation in the thickness of the glass in the tube's face; the tolerance in the bayonet lock; the slight variation in focal length of lenses; and the fact that no film ever lies exactly flat—it is always plus or minus a few thousandths from the focal plane. If all these tolerances fall in one direction, the maximum variation might be as much as 3.4% plus or minus.

If, however, you have a 'scope with an illuminated grid, and record the grid on the print at the same time as the trace without moving the camera between exposures, then the print should show both trace and grid with an identical tolerance, this, for practical purposes of measurement, removing any tolerance.

"*Does the paper in your print stretch equally in both directions?*" Probably not. All paper has a grain in it, and it stretches more one way than the other.

But, remember, please, that the Polaroid print doesn't get that hour-long final washing that goes even to a single-weight photographic print. In fact, the Polaroid print, as you have just seen, is actually hardly even damp clear through. Furthermore, this Polaroid paper is run through that wringer device in the camera *before* the print is transferred to it; it isn't subjected to any tension after it receives the print. So I would say that distortion due to paper stretch is negligible.

"*Your camera produces only a single print; can you make duplicates?*" Yes, simply, economically and quickly, and as many as you want, by ordinary photographic contact printing. And, better still, the duplicates are actually better than the original—and I know how strong a statement that is, for this is one of only three cases with which I am acquainted where a photographic copy is better than the original.

Simply lay the print you wish to duplicate face up on an ordinary photographic printer. Lay a sheet of unexposed *soft* photographic paper (Azo No. 1) on top of it, and then print directly through the Polaroid paper print and develop in the usual manner. It is important that the photographic paper be soft; contrast paper will lose delicate traces. Of course the resulting print will be a negative with right and left reversed, but this is usually not objectionable in making measurements.

The reason for the better quality of the duplicate print is simple: With the Polaroid-Land process a light trace will record very dark. So dark that it might not be seen by reflected light. Now if we make a print by light that passes through the original, the faint image will be recorded on the photographic paper and the contrast will be increased even when *soft* paper is used, thereby making the trace more legible than the original.

But perhaps you would prefer positive instead of negative duplicates. Very well; simply substitute a sheet of Super XX film for the photographic paper and expose it 1/4 second. This gives a film negative from which as

many duplicate positive prints as are needed may be quickly run off. Positive enlargements can also be made from this film negative, if that is desired. Of course, we suffer a slight loss in our positive duplicate prints by putting our image through a film negative before printing it upon paper. Even so, the duplicate positive prints are still a trifle better than the original.

"*How fast is the Polaroid film?*" It's ASA rating is 100, thus making its speed roughly comparable to that of Eastman's Super XX film. However, this rating means little in photographing high speed transients. What counts is the emulsion's sensitivity to a sudden blast of light, plus its spectral characteristics.

"*Is the film panchromatic?*" No; it is orthochromatic. This means that it is relatively insensitive to red; or, to put it the other way 'round, it is highly sensitive to the blue and ultra-violet, with medium sensitivity to the yellow-greens.

"*Does your camera use standard film?*" Yes; it uses the standard Polaroid-Land films, of which there are two types. Type 40 is a rich sepia, such as I have showed you this morning. Type 41 is a black-and-white film having the same characteristics. Both may be obtained from your local photo-dealer.

"*What is the price of the film?*" $1.75 per roll. This figures out at $.22 for each of the eight prints, or $.11 for each of the 16 exposures you get per roll. The film is packaged six rolls to a carton, and the price of the carton is $10.50, plus any local sales taxes. There are 48 prints, or 96 exposures, per carton.

"*Can you use the negative from this camera?*" For practical purposes, no. I have here a negative I saved by taking the camera into the darkroom and resorting to conventional photo procedure, but the gain isn't worth the trouble. And there's really no necessity for saving the negative since we can make top quality duplicates, either positive or negative, from the original print.

"*Will your camera fit any oscilloscope?*" It will fit about two-thirds of all the 5-inch 'scopes now in use. As you see, the camera is attached to the 'scope's bezel, and there was no occasion for standardizing bezels prior to the post-war appearance of oscilloscope recording cameras; consequently a few 'scopes carry bezels that are

too large, and a few are too small. Some 'scopes have no bezels. The Fairchild adapter ring is 5-5/8 inches in diameter. If the bezel is smaller, the user can usually improvise a simple metal gasket that will answer admirably. If the bezel is too large, it must be replaced, usually by the round-base bezel which we offer, and which can be installed by the user. In the case of those 'scopes that have no bezel, one must be provided, usually the square-base bezel which we also offer.

"*Why do you need a special lens?*" The need for an especially designed lens arises from the fact that we must often work at full aperture, and we must always work at the extreme close-up distance of about nine inches—conditions under which most of the general purpose anastigmats perform but poorly. Our lens, therefore, is designed specifically to meet these unusual conditions. It turns in an excellent performance.

"*Can you use this camera for general photography?*" No; this camera is designed specifically to deliver top performance on a specialized job—recording oscilloscope traces. Its lens is fixed focussed at about 9 inches. It would be difficult to set it up for other work.

"*Can you watch your trace while you are photographing it?*" Yes; the trace can be observed before, during and after the exposure through the viewing port in the hood.

"*What is the price of your camera?*" $245 for the basic unit; that is, the camera, the hood and the adapter.

"*The Polaroid camera costs only about $90; why does yours cost three times as much?*" Principally because we must substitute an especially designed new lens which is 16 times faster than the standard Polaroid lens, and this alone adds around $90 to the price of the camera. In addition, we must build the positioning device and also the hood and the adapter ring.

That, gentlemen, covers the description and the questions that have previously been asked. Have you others?

* * *

Question You left the port open when you took those pictures just now; doesn't that fog the film?

Answer Not unless there is a light shining directly into the port that produces a specular reflection from the tube's face, or one that is sufficiently bright to produce a general veiling of the tube. However, it is better practice to keep the port closed during exposure if you aren't actually using it. Of course if you are using the port, your head does the shading.

Question Will you explain what you meant by pre-solarization?

Answer Certainly. All film has an inertia. A part of the light energy that reaches the film must be absorbed in overcoming this inertia. Pre-solarization (perhaps pre-fogging would be a more descriptive term) simply means that you give the film a short over-all exposure before you expose it to the tube's trace. This overcomes the inertia so that all the light energy received by the film from the tube's trace is utilized in recording the trace. This pre-solarization works to better advantage in recording the oscilloscope trace than in any other phase of photography where I have tried it. It is easily and simply done, and full instructions are included in the operating manual.

While I haven't exact densitometer measurements yet to back up my statement, I estimate that pre-solarization at least doubles and perhaps triples the dot speed that can be recorded. Of course it also produces a grey background instead of black, the shade of grey depending upon how much pre-solarization was given. Surprisingly, the trace shows up better on the grey background.

Question Suppose you still can't record a fast single transient even with pre-solarization?

Answer Well, if it is one of those once-in-a-blue-moon cases where only one trace, or a very few traces, of extreme speed simply *must* be recorded, we still have one more trick up our sleeves. We can fall back on conventional photography by dispensing with the Polaroid-Land film and slipping a sheet of highest speed 4x5 film, such as Eastman's Super Panchro Press, Sports Type, into this camera—in the darkroom of course. This has an ASA rating of 250, and it should increase our recording speeds by about three times. By the way, pre-solarization of this Super Panchro Press *can* be done, but it's a bit tricky even for a good photographer. If this won't handle it, then we have shot our bolt.

Question I'm still not quite clear about the top speed of those traces you can record, the transients, I mean?

Answer If the transients are exactly repetitive, then their speed doesn't matter because, for photographic purposes, they form a stationary pattern. We can keep our shutter open on a stationary pattern until we do get a record. If the transient crosses the tube's face just once; that is, if it's a single transient, then, under the ideal conditions already outlined, and using an accelerating potential of 3KV, we have actually recorded up to 1-inch/micro-second. We expect to exceed this figure with higher accelerating potentials. Don't forget that a 29KV accelerating potential is approximately 100 times as effective in producing an image as a 3KV signal, and 1000 times as effective as a 1500 volt signal.

CONCLUSION

Are there further questions? If not, then let me summarize briefly what has been said here:

1) The Fairchild-Polaroid Oscilloscope camera is a new laboratory instrument, designed specifically to speed up electronic laboratory and shop work by putting into the operator's hand a photographically accurate record of the oscilloscope's trace about 60 seconds after it has occurred. This done right in his own lab or shop. No darkroom is needed.

2) The print is ready for immediate evaluation. Data can be recorded upon it, or put into the notebook with the print mounted beside it.

3) This is accomplished by means of the new and revolutionary Land one-step process of photography.

4) The camera consists of but three simple units that can be set up and ready for recording within two minutes. It can be dismounted and returned to its case also within two minutes.

5) This camera differs from the standard Polaroid unit in that it carries an especially designed, 16 times faster lens, plus special positioning and focussing devices.

6) The "snap shooter" engineer can do an excellent job. An expert photographer isn't needed.

7) All stationary patterns, and most of the single transient traces usually encountered, can be recorded. These represent perhaps 80% of all the work in most labs. A few of the highest speed traces cannot be recorded, nor, of course, can any still camera record continuously varying phenomena.

8) This camera delivers one positive print, 3-1/4 by 4-1/4 in size. This print is so divided that two traces can be recorded upon it.

9) The record is one-half life-size; enlarging is rarely needed.

10) Either positive or negative duplicate prints can be made in any quantity, quickly and economically, by conventional contact photographic printing. Enlargements can also be made.

11) The camera uses either type of standard Polaroid-Land film, available from your local photo dealer.

* *

For these reasons, we believe that this camera is a definite and widely useful addition to electronic laboratory equipment.

Quite elaborate oscilloscope equipment has been provided here for us, and we would be glad to have any of you gentlemen come up, put traces characteristic of your own work on the tube, and let us show what the camera can do for you. And we'll be glad to answer further questions that may occur to you, and to have you operate the camera yourselves.

We are appreciative to you for taking time out of a busy morning to come over here to see our new camera. We believe it does represent a definite addition to electronic laboratory and shop equipment—an addition that will make your work faster, more accurate, and more convenient, and that will put a lot of records on paper that memory alone must now carry.

The entire text of this booklet was composed on the Fairchild Lithotype.

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